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ABSTRACT

Confirmatory maximum likelihood estimation of measurement models was used to evaluate the construct generality of self-report measures of anxiety across male and female samples. These measures included Spielberger's State-Trait Anxiety Inventory, Taylor's Manifest Anxiety Scale, and two forms of Endler, Hunt and Rosenstein's S-R Inventory of Anxiousness. Data from 256 females and 135 males were analyzed by testing a sequence of hypotheses regarding equality of measurement properties of each scale across groups. The generality of the measurement model identified for each scale was assessed by examining the extent to which the obtained model was factorially invariant across sex groups. Results indicate that, with the exception of the Manifest Anxiety Scale, all measures obtained statistically invariant factor patterns across groups. Implications of these findings for the measures' practical use in multiple group comparisons are discussed. (Author/PN)

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Maximum Likelihood Estimation of Factor Structures of Anxiety Measures: A Multiple Group Comparison

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Maximum Likelihood Estimation of Factor Structures of Anxiety Measures: A Multiple Group Comparison

Abstract

Confirmatory maximum likelihood estimation of measurement models is used to evaluate the construct generality of self-report measures of anxiety across male and female samples. These measures include Spielberger's State-Trait Anxiety Inventory, Taylor's Manifest Anxiety Scale, two forms of Endler, Hunt and Rosenstein's S-R Inventory of Anxiousness. Data from 256 females and 135 males are analyzed by testing a sequence of hypotheses regarding equality of measurement properties of each scale across groups. The generality of the measurement model identified for each scale is assessed by examining the extent to which the obtained model is factorially invariant across sex groups. Results indicate that with the exception of the Manifest Anxiety Scale, all measures obtained statistically invariant factor patterns across groups. Implications of these findings for the measures' practical use in multiple group comparisons are discussed.

While considerable attention has been devoted to determining the empirical validity of general and specific measures of anxiety, relatively few studies have rigorously examined the "theoretical validity" (Lord & Novick, 1968; Bohrnstedt, forthcomming) of these measures. Among these studies, assessments of theoretical validity have largely focused on a single type, namely, construct validity. However, systematic attempts to assess a second equally important type of theoretical validity called "structural validity" (Loevinger, 1957, p. 681) are notably lacking in the psychometric literature on self-report measures of anxiety. In light of this deficiency, the present study examines two questions regarding the theoretical validity of five frequently used measures of anxiety. Our concern is with anxiety as a latent construct and our goal is to evaluate the adequacy of measurement models which define the structure of linear composites designed to measure this construct for specific populations.

Our first question, motivated by pervasive use of anxiety measures in current psychological research, asks how well item responses in a particular measure cohere given the underlying measurement model implied by such use. In terms of test score theory this question concerns the extent to which observed item responses correlate with an underlying, latent construct. This question is traditionally approached within a factor analytic framework (Green & Carmines, 1980) and gives rise to the commonly used internal consistency measures of reliability.

Our second question, motivated by comparisons of anxiety scores across sex groups, asks whether such mean level comparisons can be meaningfully made across these populations for a given measure of anxiety. This second question refers to the extent to which the latent theoretical

construct of interest generalizes across the populations of interest. We argue that determination of construct equivalence is a prerequisite for valid population comparisons. Specifically, theoretical inferences based on mean level comparisons of scores from measures that differ structurally over different populations are open to question because it is difficult, if not impossible, to assume that the measured variables indeed represent the same underlying construct over the populations of interest. Thus, unless structural or factorial invariance of a measure is demonstrated across populations, the generalizability of construct interpretations of these measures may be seriously questioned (c.f. Sörbom, 1974; Alwin & Jackson, 1981).

Despite the above concerns, it is commonly assumed that frequently used educational and psychological measures do indeed assess a common construct across populations. This assumption is perpetuated in research applications which compare populations with little or no empirical evidence to justify such comparisons. The purpose of this study is to address these issues by first identifying the factor structures underlying the five measures of anxiety and comparing these structures with the structures implied by the use of these measures in current research. The measures examined include state (SAI) and trait (TAI) forms of Spielberger's State-Trait Anxiety Inventory (1970), two forms of Endler, Hunt and Rosenstein's (1962) S-R Inventory of Anxiety and Taylor's (1953) Manifest Anxiety Scale (MAS). Since these scales are commonly used as unidimensional measures of the anxiety construct, we subsequently evaluate the adequacy of the single factor measurement model underlying this usage. Secondly, the generality of the measurement model implied by the factor structures obtained in our analysis is assessed by examining

the extent to which the model obtained for each measure is factorially invariant across sex groups.

Structures of Self-Report Anxiety Measures

Selection of the above measures was based on two major considerations. First, a review of the anxiety assessment literature suggests that these measures are among the most frequently used self-report instruments in a variety of research settings. Secondly, with the exception of Taylor's MAS, each instrument was developed within the context of current theoretical discussions regarding the nature and assessment of anxiety. For example, Spielberger's trait and state forms of the STAI were developed to test his theory which emphasizes the conceptual distinction between state and trait anxiety in describing variations in anxiety responses.

While Spielberger's theoretical model underscores this important distinction, a second, currently popular approach is represented by the work of Endler, Hunt and Rosenstein. Endler and his colleagues have proposed a person by situation interaction model of anxiety to account for inter- and intra-individual variations in anxiety reponses. This position emphasizes the importance of person variables and situation variables as well as the interactions of these two sources in influencing anxiety responses. Thus, the S-R Inventory of Anxiousness (SRI) was developed to test predictions from an interactional model of behavior. The two situations for which SRI ratings of anxiety response were obtained in the present study, exam (EHE) and public speaking (EHS) were selected for their relevance to our sample of college students. Finally, Taylor's MAS was included for examination because of its rich history in a variety of research applications.

While all five measures have been factor analyzed, disagreements still exist concerning the structures underlying each measure. Furthermore, studies of sex differences in anxiety are reported much more frequently for specific anxiety states (death anxiety, test anxiety, etc.) than for any of the self-report measures of general anxiety examined in this study. In this regard, Eckhammar (1974) reports a lack of cross sex comparisons for general inventories of anxiousness and cites a lack of relevant statistical information as a common feature of studies on sex differences in anxiety. Our review of the current literature leads to simila- conclusions.

Only a few studies have considered the question of sex differences in anxiety within a factor analytic framework. For example, Endler et. al. (1962) report factor analytic results for 11 forms of the S-R Inventory of Anxiousness. The eleven forms contain identical items representing 14 modes of response; however, each differ with respect to the situations for which the 14 modes of response are rated. Endler et.al. (1962) report three modes of response factors labeled (1) distress-disruption-avoidance or "distress" factor, (2) exhilaration-enjoyment-approach or "exhilaration" factor and, (3) "autonomic" factor representing dry mouth, nausea, respiratory and other physiological reactions. The multifactorial composition of this measure has been confirmed in later studies by Endler and Hunt (1966) and Eckhammar et. al. (1974). The latter study suggests a slightly different factor structure, one factor labeled "psychic anxiety" representing feelings of worry, nervousness and panic, a second "uninteresting" factor loading on only three items representing muscle tension and autonomic arousal, and a third "somatic anxiety" factor representing different kinds of somatic

reactions. Differences between factor structures reported in these two studes are not surprising because of differences in sample composition (American college students versus Swedish high school students) and differences in the number of items examined in the two studies (14 versus 18 modes of response).

Studies of sex differences using Endler's S-R Inventory of Anxiousness are almost nonexistent with the exception of a series of studies from the University of Stockholm (Eckhammar, 1974; Eckhammar & Magnusson, 1972, 1973; Magnusson & Stattin, 1977; Olah et. al., 1978). Eckhammar (1974) reports sex differences for total scores, factor scores and single item means with females scoring higher and showing greater variability than males.

Factor analyses of the STAI have emphasized the distinction between state anxiety and trait anxiety (Gaudry & Poole, 1975; Gaudry et. al., 1975; Endler & Okada, 1975; Kendall et. al., 1976; Naylor, 1978; Loo, 1979; Logan & Loo, 1979). Factoring items from both trait and state anxiety scales in combination, Kendall et. al. (1976) report three interpretable factors. The first trait factor, labeled "A-Trait Cognitive Anxiety," includes items concerning worry, rumination, and disappointment. The second and third factors are both composed of state scale items, "A-State Negative Descriptors" dealing with feelings and behavioral manifestations of nervous tension and "A State Positive Descriptors" dealing with feelings of happiness, certainty and self-confidence. Kendall's findings are supported by Naylor (1978); however, Loo (1979) and Endler and Manusson (1976) argue for a multidimensional A-Trait Scale.

Unlike the S-R Inventory, the STAI has been the measure of choice in many studies on sex differences in anxiety (Sanderson & Ashton, 1981;

Aiello, 1980; Tullman, 1979; Edwards, 1979; Ward et al., 1979; Rath, 1978; Polyson, 1978; Kase et al., 1978; Auerbach & Kendall, 1978). The majority of these studies treat state and/or trait anxiety as unidimensional constructs and report only group means. However, the work of Loo (1979) provides an instance in which both the dimensionality of the factor structure and the appropriateness of pooled versus separate analyses by sex is considered. Loo concludes that the A-Trait Scale is multidimensional and that the affective dimension of this scale is similar across sex, while the other factors may vary across sex. He further suggests that factor pattern comparisons be made prior to pooling data across sex.

The Taylor Manifest Anxiety Scale has a long history of factor analytic studies (Bendig, 1958; O'Connor et.al., 1956; Fenz & Epstein, 1965; Kahn, 1970). O'Connor et.al. (1956) factor analyzed 42 of the original 50 items, eliminating eight items with marginal frequencies less than 10%, for a sample of 220 male undergraduates. Results suggested at least five independent dimensions of anxiety: chronic anxiety, physiological reactivity, intense inner strain, personal inadequacy and motor tension. Fenz and Epstein (1965) examined the factorial composition of three subscales of the MAS to determine the extent to which these could be represented by one general factor. Rather than factoring item correlations, Fenz and Epstein factor analyzed scores on scales labeled autonomic arousal, striated muscle tension and feelings of anxiety. Results showed a general anxiety factor and a specific factor associated with striated muscle tension. Fenz and Epstein conclude that "while it is justified to combine all anxiety items into an overall score, as is done in the Taylor MAS, information is lost by not grouping items into

a separate subscale of striated muscle tension" (p. 778). Kahn (1970) investigated the dimensionality of the MAS by changing item response categories from dichotomies to 5 pointscales ranging from "rarely" to "almost always." Kahn factor analyzed the correlation matrix of item responses separately for males and females and reported five interpretable factors for each sex. Factor 1 was interpreted as "tension anxiety" for both males and females. Factor 2 was labeled "personal inadequacy" for both sexes, though salient loadings differed somewhat. Factor 3 appeared as indicative of agitation, though females evidenced a physiological component (stomach trouble, restlessness) to a greater extent than males. Factor 4, "inner tension" was described for males as "hysteria" accompanied by a physiological reaction. For females, factor 4 represented items concerned with blushing and embarrassment. Factor 5 was very different for males and females, representing "psychosomatic fitness" for the former and "betrayal of inner self" for the latter. In sum, Kahn's findings support O'Connor's (1956) multidimensional model of anxiety discussed above, and his findings further indicate that different factor patterns exist for males and females. Thus, these results suggest that the MAS measures more than one dimension of anxiety and that these multiple dimensions differ for male and female groups.

Recent studies that report sex differences in the MAS have been concerned with manifest anxiety as a predictor of performance (Justice et al., 1978), have sought to use MAS scores as a basis for creating experimental groups (Breuer and Lindaver, 1977), and have examined the relationships between manifest anxiety and other concepts (Wen and McCoy, 1976; Gall, 1969). In light of the factor analytic findings discussed above, results of these studies should be interpreted with extreme

caution. The MAS items appear to represent different latent constructs for male and female groups, and, thus, the meaningfulness of cross sex comparisons are highly questionable.

In sum, our review of the factor analytic literature on these anxiety measures indicates a lack of systematic attempts to examine cross population generality of the latent construct that purportedly underlies each measure. With the exceptions of a few studies, it is generally assumed that a common latent construct underlies the observed covariation among items across gender populations. This assumption is evident in the majority of studies where (1) mean total score and/or factor score comparisons are made across populations without prior evidence that a common latent construct indeed represents the observed covariation among items for the populations of interest and (2) exploratory factor analyses are conducted on a mixed sample of male and female subjects, again without empirical justification for combining samples.

Data Analytic Strategy

Concern with the correspondence of factors identified for different populations has generated a variety of techniques for factor structure comparison (Rummel, 1970; Mulaik, 1972). Recent articles by Jöreskog (1971) and Sörbom (1974) have demonstrated the merits of simultaneous factor analysis within a confirmatory factor analytic framework for testing differences between structural models across multiple groups of populations. Alwin and Jackson (1981) extend these discussions by clarifying the prescribed statistical procedures to examine issues of factorial invariance in a common factor model. Given the aims of our study, we first establish a factor model for each anxiety measure based on the total group of subjects in our sample. This initial model

provides the basis for our examination of the factorial invariance of each measure across male and female groups using the statistical procedures suggested by the above authors. The implications of these evaluations for each measure's practical use will be subsequently explored.

Method

Participants and Materials

Three hundred and ninety-one students, 256 females and 135 males, completed a battery of questionnaires which included both trait (TAI) and state (SAI) forms of Spielberger's State-Trait Anxiety Inventory, Taylor's Manifest Anxiety Scale (MAS), and two forms of Endler's S-R Inventory of Anxiousness. Ratings for different anxiety arousing situations were obtained in the separate S-R forms--a public speaking situation (EHS) and a course examination situation (EHE). These measures were administered in standard small group sessions with assurances of confidentiality of individual results.

Statistical Procedures to Evaluate Reliability

Numerous measures of reliability are available to the psychological researcher. The two reliability coefficients of current interest, Cronbach's (1951) coefficient alpha, and the Tucker-Lewis (1973) reliability coefficient (TLRC), are both dependent on inter-item correlations. However, as Heise and Bohrnstedt (1971) point out, a high value of alpha may be obtained when a number of different constructs are being assessed by the same linear composite. This is because the coefficient alpha does not pertain to the theoretical validity of a composite. Our concern is the ability of a k factor model to represent the interrelationships among items in a linear composite, where the k factors represent distinct components of anxiety. Clearly, alpha is unsuitable for this purpose. Alternatively, the TLRC is directly associated with a given

factor analytic solution and may be interpreted as the ability of a k common factor model to represent the covariances among items (Tucker & Lewis, 1973, p. 5). Low values indicate a poor fit of the model and suggest that relations among items may be more complex than can be represented by a model with k common factors.

Statistical Procedures to Evaluate Factorial Invariance

Our analyses follow statistical procedures suggested by Jöreskog (1971) and Alwin and Jackson (1981). These procedures involve testing a sequence of hypotheses regarding a scale's measurement structure. Hypotheses regarding the measurement structure are tested by evaluating the fit and presumed equality of two parameter estimate matrices over the populations of interest--the factor pattern matrix (λ) and the matrix of the covariance structure of disturbances, representing measurement error (ψ). Ultimately, the hypothesis of invariant factor patterns must be accepted in order to make valid comparisons across groups.

Equality of the above parameter matrices is tested sequentially as follows. First, a decisive, preliminary test of invariance is conducted to evaluate the equality of covariance structures (Σ) of the observed items across groups. It is a decisive test in that should this hypothesis be accepted, the parameters of the model may be assumed to be invariant at some probability level. However, rejection of this hypothesis requires continued testing of invariance hypotheses to determine the source(s) responsible for the inequality of covariance structures of observed items. If this preliminary hypothesis is rejected, the subsequent hypothesis to be tested is that which specifies equality of factor pattern matrices. If this hypothesis is accepted, an additional hypothesis may be examined, equality of covariance structures of measurement error

(hereafter referred to as "error variance"). These tests provide information regarding the relative impact of these potential influences on the differences among covariance structures across groups. Following these procedural guidelines, generalizability of the factor model implied by the use of these five anxiety measures across sex groups is examined.

RESULTS

Table 1 summarizes scale statistics for each of the five anxiety measures. Values are given for males and females, separately and combined.

Table 1 About Here

No significant differences were found between males and females for demographic variables, including age, marital status and ethnic background.

Item intercorrelations computed for each measure were separately factor analyzed by the maximum likelihood technique (Jöreskog & Sorbom, 1978). The number of factors extracted was based on (1) the eigenvalue associated with each factor (i.e. only factors with eigenvalues greater than one were extracted); (2) the number of items with meaningfully large loadings on each factor (i.e. factors with less than three items loading greater than .35 were disregarded as unique factors); (3) the ability to reach an interpretable simple structure after oblique (promax) rotation; (4) suggestions provided by previous factor analytic studies; and (5) Tucker-Lewis reliability coefficients associated with each solution.

As shown in Table 2, all five measures obtained reasonably high Tucker-Lewis coefficients when an appropriate k-factor measurement model was examined.

Table 2 About Here

The MAS obtained the lowest (.857) and the EHS the highest coefficient (.942). These differences partly reflect the number of factors extracted (one versus three factors); however, we were unable to reach a meaningfully interpretable structure with the MAS regardless of the number of factors extracted. Identically clear three-factor solutions emerged for both forms of the S-R Inventory of Anxiousness (i.e., speech and anxiety situations) and both obtained TLRC's above .93. Since similar factor patterns were obtained by Endler et al. (1962), we correspondingly labeled these factors "distress," "exhilaration" and "autonomic arousal." Analyses of Spielberger's STAI produced similar solutions each with two factors clearly identifiable as a "positive item" factor (e.g. calm, secure) and a "negative item" factor (e.g., tense, upset). TLRC's for these solutions were .876 (SAI) and .929 (TAI). The above factor analytic solutions describe measurement models which best represent the covariation among item responses for the respective measures given the five guidelines cited above. These models provide the bases for subsequent tests of hypotheses regarding the factorial invariance of measures across male and female groups.

Table 3 summarizes the results of the analyses conducted to test the invariance of structures across males and females for each anxiety measure. It should be noted that these analyses were performed on covariances, rather than correlations, and thus comparisons are not confounded by differences in group variances (c.f. Alwin & Jackson, 1981).

Table 3 about here

The hypothesis of invariance of covariance structure of items ($H_0: \Sigma_F = \Sigma_M$) is presented in Table 3a. This hypothesis is rejected for all measures except the EHS. Thus, we accept the hypothesis of equal measurement

structures across sex for this scale and further examine the remaining four measures.

Table 3b shows that we reject the hypothesis of invariant factor patterns ($H_0:\lambda_F=\lambda_M$) only for the MAS ($\chi^2 = 46.38, df=27, p < .05$). In Table 3c we examine the equality of error variances ($H_0:\psi_F=\psi_M$) for the three anxiety inventories for which this would be a necessary and meaningful test. Error variances are significantly different for the TAI and EHE, whereas no significant difference was found for the SAI ($\chi^2 = 30.58$, df = 20).

In sum, the results of Table 3 show that measurement structure invariance across both parameter matrices of concern may be assumed for the SAI and EHS. The TAI and EHE both showed invariant factor patterns, but differed with respect to cross sex comparisons of error variance. Only the MAS showed significant differences in factor pattern across sex.

DISCUSSION

Dimensionality of Anxiety Measures

The present results suggest that of the five anxiety measures, only the Manifest Anxiety Scale is best conceptualized as unidimensional; however, the meaningfulness of the single-factor model for the MAS appears questionable due to the uninterpretability of the obtained pattern. Specifically, our results show that all of the salient items marking the single factor are relatively low. This suggests that if additional factors were extracted, rotation to a more meaningful solution might be possible. Attempts to implement this strategy were unsuccessful because no clear and meaningful transformations emerged when multiple factors were extracted. In sum, while one factor underlies the covariation among

the MAS items, short of labeling this factor "general manifest anxiety," it is difficult to provide a meaningful interpretation of the items marking it.

Evaluations of the remaining measures indicate that a multidimensional rather than a unidimensional model best represents the observed covariations among items for each measure. Our findings are in agreement with those of Endler et al. (1962), Ekehammar (1974), Kendall et al. (1976), Loo (1979), Loga[illegible]nd Loo (1979), and argue against a single summary score as a basis for assessing degree of anxiety. Thus, our results in combination with those reported by these investigators indicate that the construct of anxiety is multidimensional and that measurement of variations in self-reported anxiety responses is best achieved by measuring the constituent patterns of anxiety. In this way, both theoretical assumptions and empirical data provide the bases for informed selection of an appropriate measurement model and for the logical interpretations of empirical results.

Observed Factor Structures and Congeneric Measurement Models

Factor analyses of the Spielberger and Endler anxiety inventories produced clearly interpretable two and three factor solutions. The situation scales of Endler's measure (EHE and EHS) obtained three maximum simple structure solutions. The clarity of these factors, representing distinct aspects of psychological and physiological functioning, suggests a congeneric model in which each item obtains a factorial complexity of one (Alwin & Jackson, 1980; Jöreskog, 1971 b).

Factor analyses of Spielberger's trait and state measures also produced results in strong agreement with previous research. The "positive indicators" and "negative indicators" factors that emerged for the SAI correspond with those obtained by Loo (1979). The structure of the TAI

also showed both "positive" and "negative" factors in agreeement with the results of Loo (1979) and Endler and Magnusson (1976). In contrast, Kendall et al. (1976) obtained a single factor solution for the TAI, labeled "A-Trait Cognitive Anxiety;" however, this discrepancy may be attributable to the fact that Kendall analyzed both scales in one analysis rather than submitting both measures to separate analyses.

The Endler measures and the Spielberger measures are similar in that they both suggest multidimensional solutions with distinct loading on each factor. However, while factor patterns that emerge for Endler's measure represent theoretically meaningful components of "anxiety," the two factors obtained for Spielberger's measure represent item wording as opposed to substantively distinct aspects of the anxiety construct.

In order to consider the appropriateness of cross sex comparisons based on factor structures derived above, it is necessary to select a measurement model against which the hypotheses of invariance may be tested. This model is used to bridge the gap between the exploratory factor analytic framework used above and a confirmatory hypothesis testing framework within which hypotheses of invariance of measurement structures are testable. For this purpose, we selected a constrained k-factor measurement model rather than an unconstrained model. The constrained model is one in which each item has a factorial complexity of one and reflects a congeneric measurement structure (Jöreskog, 1971b; Alwin & Jackson, 1980). In an unconstrained model, items may load on any factor, although certain constraints are needed to identify the model. The congeneric measurement model was chosen because this model is more parsimonious and represents our concern with anxiety as a construct composed of clearly defined dimensions.

Factorial Invariance: Cross Sex Comparisons

Our findings indicate that with the exception of the MAS, measurement structures for males and females are invariant. This suggests that the true score variance for each measure (except the MAS) is approximately equal across sex groups; consequently, cross sex comparisons of factor scores for these groups is justifiable. In contrast, it appears that the MAS represents something different within each group. As such, the appropriateness of this measure for assessing "anxiety" within a population consisting of both male and female students is highly questionable.

With regard to invariance of the error structures across sex, our findings suggest that error structures are invariant for the EHS and SAI, while those for the EHE and TAI are significantly different. To conform with assumptions underlying the common factor model, the matrix of error covariances was assumed to be diagonal; thus, off-diagonal covariances were constrained to zero.

The practical import of these findings is that item variances may be statistically different for some of the EHE and TAI items, and that differences in some linear combination of error variances may be statistically significant. For the SAI, invariance found between male and female error variance matrices indicate that the initial differences found in item covariance structures may be due to differences in other than measurement structure matrices (i.e., the factor structure matrix and/or the matrix of latent factor means). Consequently, if the hypothesis of invariant error structures is rejected, one may wish to examine the item variances because sex differences in response patterns may not be evident in an examination of the factor matrix itself.

In sum, we have attempted to demonstrate the importance of evaluating a scale's measurement properties, particularly when the scale is to be

used for cross cultural, cross ethnic, and cross gender comparisons. Such usage require evidence that the same relationships between variables and factors of the measurement model exist in the populations of interest. If it can be demonstrated that a common underlying construct is indeed measured within the populations of interest, then meaningful comparisons on, and inferences about, the measured construct(s) are justified.

The present study demonstrates the usefulness of Jöreskog and Sörbom's confirmatory statistical procedures to evaluate the appropriateness of construct interpretations of measurement instruments across populations. As with most statistical procedures, there are caveats. Maximum likelihood χ^2 tests examining multiple sets of parameter matrices are not independent and tend to be sensitive to the effects of sample size. Thus, it would not be unlikely to find factor structures which appear highly similar using an "eyeball" analysis or which are shown to be highly correlated and, yet, are statistically different on the basis of tests used here. Despite these cautions, our sample of almost 400 demonstrated invariant factor patterns on four out of five measures, even when the more restrictive congeneric measurement model was selected.

TABLE ONE

Scale Summary Statistics for Five Measures of Anxiety

Anxiety Scale	$\bar{X}$			S			α_Z			N Cases		
(N items)	T	M	F	T	M	F	T	M	F	T	M	F
SAI (20)	37.43	36.99	37.71	10.46	10.85	10.28	.926	.933	.923	382	134	248
TAI (20)	41.72	39.34	42.94**	10.25	9.81	10.29	.907	.909	.903	380	129	251
MAS (28)	11.43	10.53	11.92*	5.68	5.35	5.80	.838	.818	.845	385	132	253
EHS (14)	38.39	38.48	39.89	9.01	8.52	9.25	.834	.818	.843	386	131	255
EHE (14)	36.30	35.30	36.80	9.53	9.33	9.62	.845	.841	.843	385	132	253

*$p < .05$ **$p < .01$

SAI: Spielberger's State Anxiety Inventory
TAI: Spielberger's Trait Anxiety Inventory
MAS: Taylor's Manifest Anxiety Scale
EHS: Endler-Hunt Speech Anxiety
EHE: Endler-Hunt Exam Anxiety

$\bar{X}$ = Scale Mean
S = Scale Standard Deviation
α_Z = Standardized Item Alpha
T = Total
M = Males
F = Females

TABLE TWO

Summary of Factor Analytic Results for
Five Measures of Anxiety

Anxiety Scale (N items)	K Factors	Items by Factor*	Factor Name	T.L.R.C.
SAI(20)	2	Factor 1: 1,2,5,8,10,11,15,16,19,20	Positive Items	.876
		Factor 2: 4,6,7,9,12,13,14,18	Negative Items	
TAI(20)	2	Factor 1: 1,6,7,10,13,16,19	Positive Items	.929
		Factor 2: 2,3,4,5,8,9,11,12,14,15, 17,18,20	Negative Items	
MAS(28)	1	Factor 1: 1,2,4,5,7,8,9,17,20**	General Anxiety	.857
EHS(14)	3	Factor 1: 1,2,3	Distress	.942
		Factor 2: 4,5,8,12	Exhilaration	
		Factor 3: 6,7,9,10,11,13,14	Autonomic Arousal	
EHE(14)	3	Factor 1: 1,2,3	Distress	.934
		Factor 2: 4,5,8,12	Exhilaration	
		Factor 3: 6,7,9,10,11,13,14	Autonomic Arousal	

*Underlined item numbers indicate loadings less than .35

**All remaining MAS items loaded >.35

SAI: Spielberger's State Anxiety Inventory

TAI: Spielberger's Trait Anxiety Inventory

MAS: Taylor's Manifest Anxiety Scale

EHS: Endler-Hunt Speech Anxiety

EHE: Endler-Hunt Exam Anxiety

T.L.R.C.:Tucker Lewis Reliability Coefficient

TABLE THREE

Analysis of Covariance Structures and

Factor Pattern Structures Across Sex

Anxiety Scale	a Covariance Structure of Items			b Factor Pattern		c Covariance Structure of Disturbances	
(N items)	χ^2_Σ/dF	p.	K Factors	χ^2_Λ/dF	p.	χ^2_ψ2/dF	p.
TAI(20)	275.15/210	<.001	2	26.33/18	>.05	52.48/20	<.05
SAI(20)	306.3 /210	<.001	2	21.26/18	>.05	30.58/20	>.05
MAS(28)	*		1	46.38/27	<.05*	——	——
EHE(14)	162.24/105	<.001	3	18.97/11	>.05	42.74/14	<.001
EHS(14)	94.54/105	=.758	3	——	——	——	——

*Computer core storage was insufficient to perform this test

SAI: Spielberger's State Anxiety Inventory

TAI: Spielberger's Trait Anxiety Inventory

MAS: Taylor's Manifest Anxiety Scale

EHS: Endler-Hunt Speech Anxiety

EHE: Endler-Hunt Exam Anxiety

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